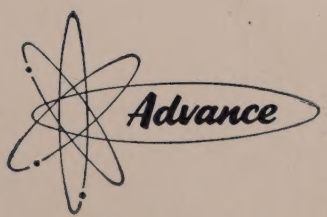
R.F. Signal Generator B4

Including B4A, B4B, B4AC and B4BC

Instruction Manual



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Instruction Manual

ADVANCE ELECTRONICS LIMITED

INSTRUMENT DIVISION

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1 Introduction

The Advance RF Signal Generator type B4 is primarily intended as a laboratory instrument and is available with alternative frequency ranges covering either 100kc/s to 80Mc/s or 30kc/s to 30Mc/s.

Basically the instrument is a Hartley oscillator with six switched inductors and a variable capacitor directly calibrated to an overall accuracy of $\pm 1\%$. Provision of a vernier scale facilitates re-setting. Continuous adjustment of the r.f. output level is provided between $1\mu V$ and 100mV by means of a non-inductively wound potentiometer and step attenuator. The level can be accurately set by use of a diode voltmeter that monitors the level into the step attenuator.

The output signal can be modulated internally by 400c/s to a depth between 0 and 80%, or an external modulating source may be used. Both internal and external modulation depths are monitored and an output of 400c/s is available when the internal modulation is in use. All oscillating circuits are well screened and stray radiations have been kept to a level of less than $1\mu V$.

2 Specification

Frequency Ranges

B4A100kc/s to 80Mc/s in six ranges. Accuracy ±6%

Range A:	100- 300kc/s	Range D:	3-10Mc/s
Range B:	300-1000kc/s	Range E:	10-30Mc/s
Range C:	1- 3Mc/s	Range F:	30-80Mc/s

B4B 30kc/s to 30Mc/s in six ranges. Accuracy ±1%

Range A:	30- 100kc/s	Range D:	1- 3Mc/s
Range B:	100- 300kc/s	Range E:	3-10Mc/s
Range C:	300-1000kc/s	Range F:	10-30Mc/s

R.F. Output Voltage

Accuracy ±(1dB +2% F.S.D.).

The output voltage from the 75Ω attenuator is fed into a 75Ω transmission line which is terminated with a 75Ω dummy aerial pad TP1D. The output into 75Ω is continuously variable from 1μV to 100mV by means of a 4-step decade attenuator and a continuously variable control. The signal is monitored after the variable control to ensure accuracy at high frequencies.

Output Impedance

The output impedance at the end of the unterminated transmission line is 75Ω. When terminated by the Termination Pad type TP1D supplied with the instrument, three impedance values are available:—

(1) 37Ω (with full output).
(2) 10Ω (with one-tenth indicated output).
(3) A standard dummy aerial (with one-tenth indicated output).
50Ω models available on request (B4AC and B4BC).

Internal Modulation

Frequency 400c/s ±10%

Modulation depth 0 to 80%; ±1dB ±2% F.S.D.

External Modulation

B4A 10c/s to 30kc/s, 0 to 80% for frequencies less than 1/30th of the carrier frequency.

B4B 10c/s to 10kc/s, 0 to 80% for frequencies less than 1/30th of the carrier frequency.

Approximately 10% modulation depth per volt input into high impedance is obtained. The modulation depth is monitored. Accuracy ±1dB.

A.F. Output

This is obtained from the internal modulation oscillator at approximately 400c/s. Output is approximately 0 to 10V into 600Ω.

R.F. Leakage

Good screening and filtering have reduced stray radiation to less than 1μV.

Valves

Each instrument is supplied with the following:—

1 ECC 91 Mullard valve (6J6)
1 6SN7GT valve
1 6X5GT valve
1 Pilot lamp, neon type, 100 to 125V

Accessories Supplied

1 Termination and Dummy Aerial Pad, TP1D
1 Shielded R.F. Feeder, complete with plugs, PL5B
1 Shielded A.F. Lead, complete with plug and crocodile clips, PL18B
1 Supply Lead, PL39

Power Supply

B4A, B4AC, B4B and B4BC: 110, 210, 230, 250V 40-100c/s.

Consumption approximately 25W.

Weight

25lb (11.4kg) nett.

Dimensions

Width 13in., height 12⅜in., depth 7¼in. (33 × 31.4 × 18.4cm).

Specification of Termination Pad Type TP1D

Input impedance 75Ω.

Outputs: 37Ω at full voltage.
10Ω giving one-tenth of input voltage.
A standard dummy aerial giving one-tenth of input voltage.

Details of the TP1D are shown on the circuit diagram.

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3 Operation

3.1 Supply Voltage

The B4A and B4B are normally despatched with the supply transformer set to operate at 220 to 240V, a.c. (40-100c/s). For other supply voltages, withdraw the instrument from its case by unfastening the fixing screws round the edge of the front panel, unsolder the lead on the 230-volt tag on the supply transformer, and re-solder it to the appropriate tapping point.

With the correct supply voltage applied, the instrument can be switched on. Warming up takes only a few minutes.

3.2 Frequency Adjustment

Any frequency in the range of the instrument can be selected to an accuracy of $\pm 1\%$ by means of directly calibrated scales and a band selector switch. A linearly calibrated scale with vernier is also provided to enable high accuracy of re-setting to be obtained. If a given frequency is to be required on a number of occasions, the vernier scale reading should be noted, and when re-setting, the instrument should be set to the reading. Fine frequency adjustment is easily obtained using the double slow motion drive which gives a ratio of 25:1. When desired, however, the knob on the main dial may be used to swing from one end of the band to the other.

3.3 R.F Output Level

The r.f. output into a 75Ω load, or available at the 37Ω socket of the terminating pad type TP1D, is variable between 1μV and 100mV by means of a continuously variable control and a five position step attenuator, each step representing 20dB. The output voltage is monitored at the input to the attenuator (after the continuously variable control) by a diode voltmeter with an open scale. This method avoids the frequency errors inherent in the continuously variable control.

To read the output voltage, press the switch marked METER-MOD-CW into the CW position. The output voltage available into a 75Ω load or at the 37Ω socket of the TP1D is the product of the reading of the meter, which is calibrated 0 to 15, and the setting of the step attenuator marked X1μV, X10μV, X100μV, X1mV, X10mV.

For accurate reading at the higher frequencies the output line must be correctly terminated, but up to about 5Mc/s the output voltage may be doubled with a slight error by omitting the termination.

When using the 10Ω socket or the dummy aerial socket on the termination pad, the output voltage is one-tenth of the indicated output.

3.4 Internal Modulation

The signal can be internally modulated from 0 to 80% at 400c/s. With the modulation switch set to INT MOD, modulation depth is varied by the SET MOD control. The modulation depth is monitored when the MOD-CW switch is set to MOD. Since the modulation depth is determined by the ratio of modulating voltage to h.t. voltage, it is advisable to maintain the a.c. supply voltage to the generator accurately.

3.5 External Modulation

The external modulating signal is injected into the A.F. socket with the modulation switch set to EX. MOD. Input impedance is high and a d.c. blocking capacitor is incorporated.

The signal can be modulated from an external source up to 80%, the acceptable modulation frequency being 10c/s to 30kc/s into B4A and 10c/s to 10kc/s into B4B. The upper modulation frequency is limited to 1/30th of the carrier frequency. It is desirable that the supply input voltage is accurately maintained so that the metering is accurate.

3.6 Audio Frequency Output

The signal is available at the A.F. socket from the internal 400c/s modulating oscillator when the modulating switch is at INT. MOD. Approximately 0 to 10V is available into 600Ω, varied by the MOD control. This output is taken from the secondary winding of the modulation transformer and has a low d.c. resistance to earth.

4 Maintenance

4.1 Recalibration of Meter Ranges

The circuits monitoring carrier level and modulation depth are correctly adjusted before leaving the factory. After prolonged service, recalibration may be accomplished using preset potentiometers RV33 and RV18. When the case is removed (para. 3.1), these potentiometers will be found immediately below the supply transformer.

(a) Recalibration of Carrier Level

With the OUTPUT VOLTAGE control RV20 set fully counterclockwise, set the voltage range switch to X10mV. Connect an external diode voltmeter, calibrated at 100mV and having an input impedance of 75Ω, directly to the ATTEN. R.F. output socket. Set the Signal Generator to a frequency within the calibration range of the external voltmeter.

Adjust RV20 until the external meter reads exactly 100mV. Make the built-in meter read 10 on the CARRIER scale by adjustment of preset potentiometer RV33.

(b) Alternative Calibration of Carrier Level

With the Signal Generator set at a low r.f., preferably 1Mc/s, connect a valve voltmeter directly to the ATTEN. R.F. output socket. Set the range switch to X10mV and adjust the OUTPUT VOLTAGE control to produce a reading of 200mV on the valve voltmeter. This represents an open circuit voltage reading of the output socket. The built-in meter should be made to read 10 on the CARRIER scale by adjustment of RV33—equivalent to a terminated output level of 100mV.

(c) Recalibration of Modulation Depth

Obtain a display of the unmodulated output of the Signal Generator on an oscilloscope fitted with a graticule.

Using the OUTPUT VOLTAGE control, adjust the output level to 10 on the meter scale and the output range switch to produce a conveniently large amplitude.

Switch the modulation selector to internal and adjust the SET MOD control until the oscilloscope display indicates 50% modulation. Use the graticule with some care to avoid parallax errors.

Adjust RV18 on the Signal Generator until the MODULATION scale on the meter reads 50%. Check that a visual indication of 75% depth of modulation coincides with a scale reading of 75.

If distortion in the oscilloscope Y amplifier is causing errors, it may be necessary to connect the Signal Generator output direct to the Y deflecting plates.

4.2 Cleaning Meter Face

The meter face should only be cleaned using an anti-static cloth or other anti-static material. The use of ordinary cleaning material induces a static charge and hence errors in the meter readings.

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5 Components List

RESISTORS

Ref.			Description	Part No.
R1	15K	10%	¼ WATT R.M.A.9	1177
R2	47K	10%	¼ WATT	2933
R3	10K	10%	¼ WATT R.M.A.9	671
R4	15K	10%	½ WATT R.M.A.8	6381
R5	5.6K	10%	¼ WATT R.M.A.9	1525
R6	10K	10%	¼ WATT R.M.A.9	671
R7	15K	10%	¼ WATT R.M.A.9 B4A ONLY	1177
	22K	10%	¼ WATT R.M.A.9 B4B ONLY	1271
R8	22K	10%	¼ WATT R.M.A.9 B4B ONLY	1271
R9	22K	10%	¼ WATT R.M.A.9 B4A ONLY	1271
R10	1K	10%	¼ WATT R.M.A.9 B4A	1175
	3.3K	10%	¼ WATT R.M.A.9 B4B	2736
R11	220	10%	¼ WATT R.M.A.9 B4A	1272
	1K	10%	¼ WATT R.M.A.9 B4B	1175
R12	220	10%	¼ WATT R.M.A.9 B4B	1272
	On B4A connection is straight to coil			
R13	22	10%	¼ WATT R.M.A.9	4419
R14	1K	10%	¼ WATT R.M.A.9	1175
R15	10K	10%	¼ WATT R.M.A.9	671
R16	Not used			
R17	330K	10%	¼ WATT R.M.A.9	4408
R18	250K		Plessey 003/SER Q.C.	11078
R19	1K	5%	¼ WATT R.M.A.9	384
R20	91		Non-inductively wound pot	3754
R21	1K	10%	¼ WATT R.M.A.9	1175
R22	1.5K	10%	¼ WATT R.M.A.9	4405
R23	240	1%	HIGH STABILITY	5797
R24	743	1%	⅛ WATT High Stability	6249
R25	743	1%	⅛ WATT High Stability	6249
R26	743	1%	⅛ WATT High Stability	6242
R27	743	1%	⅛ WATT High Stability	6249
R28	120	1%	⅛ WATT High Stability	5798
R29	91	2%	⅛ WATT High Stability	6250
R30	91	2%	⅛ WATT High Stability	6250
R31	91	2%	⅛ WATT High Stability	6250
R32	82	2%	⅛ WATT High Stability	6251
R33	5K		Pre-set potentiometer	5884
R34	1M	10%	¼ WATT R.M.A.9	1171
R35	2.2M	10%	¼ WATT R.M.A.9	1180
R36	5.1K	10%	¼ WATT R.M.A.9	7496
R37	33K	10%	¼ WATT R.M.A.9	1183
R38	1M	10%	¼ WATT R.M.A.9	1171
R39	100K	10%	¼ WATT R.M.A.9	1270
R40	5.1K	10%	¼ WATT R.M.A.9	7496
R41	100K		4W potentiometer	7628
R42	1K	10%	½ WATT R.M.A.8	6911
R43	270	1%	⅛ WATT High Stability	6896
R44	100	1%	⅛ WATT High Stability	6106
R45	11	1%	⅛ WATT High Stability	6414
R46	390	10%	¼ WATT R.M.A.9	612
R47	10K	10%	Erie 9	671
R48	100K	10%	Erie 9	1270
R49	68K	10%	Erie 9	7296

CAPACITORS

Ref.		Description	Part No.
C1	A-F	3-30pF Concentric Trimmers	1620
C2	13-514pF	Variable capacitor	7368
C3	100pF	5% Lemco 1106R	2758
C4	200pF	5% Silvered Mica on B4A	7493
	750pF	5% Silvered Mica on B4B	7577
C5	330pF	5% Silvered Mica on B4A	7489
	1200pF	5% Silvered Mica on B4B	7579
C6	220pF	5% Silvered Mica on B4A	7488
	800pF	5% Silvered Mica on B4B	7578
C7	0.5μF	250V. D.C.W. Paper Tub	10770
C8	Not used		
C9	0.05μF	350V. D.C.W. Paper Tub	7491
C10	0.05μF	350V. D.C.W. Paper Tub	7491
C11	0.05μF	350V. D.C.W. Paper Tub.	7491
C12	8μF	450V. D.C.W. electrolytic	5921
C13	16μF	350V. D.C.W. electrolytic	7014
C14	16μF	350V. D.C.W. elec. B4A	7014
C15	0.04μF	Min. Metallized Paper	7485
C16	0.04μF	Min. Metallized Paper	7485
C17	0.04μF	Min. Metallized Paper	7485
C18	0.01μF	M/M 10% Hunts L6/4 (MLW) H994	5803
C19	0.04μF	Min. Metallized Paper	7485
C20	0.005μF	Moulded Mica	1524
C21	0.005μF	Moulded Mica	1524
C22	200pF	Moulded Mica	7493
C23	300pF	Min. Metallized Paper	7850
C24	10pF	20% Ceramic Disc B4A only	4274
C25	10pF	20% Ceramic Disc B4B only	4274

MISCELLANEOUS

L1	Oscillator Coil.	100-300 kc/s.	B4A	RF 541
	Oscillator Coil.	30-100 kc/s.	B4B	RF 551
L2	Oscillator Coil.	300-1000 kc/s.	B4A	RF 542
	Oscillator Coil.	100-300 kc/s.	B4B	RF 541
L3	Oscillator Coil.	1-3 Mc/s.	B4A	RF 543
	Oscillator Coil.	300-1000 kc/s.	B4B	RF 542
L4	Oscillator Coil.	3-10 Mc/s.	B4A	RF 544
	Oscillator Coil.	1-3 Mc/s.	B4B	RF 543
L5	Oscillator Coil.	10-30 Mc/s.	B4A	RF 545
	Oscillator Coil.	3-10 Mc/s.	B4B	RF 544
L6	Oscillator Coil.	30-80 Mc/s.	B4A	
	Oscillator Coil.	10-30 Mc/s.	B4B	RF 545
L7	R.F. Filter Inductance		B4A	C123
	R.F. Filter Inductance		B4B	C124
L8	R.F. Filter Inductance		B4A	C121
	R.F. Filter Inductance		B4B	C123
L9	L.T. R.F. choke			C95
L10	L.T. R.F. choke			C95
L11	R.F. Choke for a.c. supply			C83
L12	Dummy aerial inductance			
N1	Pilot Lamp, neon type, 100 to 125V.			1165
M1	100μA Meter			5880
SIA/D	R.F. Switch			8332
S2	A.C. modulation switch			7382
S3	Meter Switch DP/DT. Bulgin S270 CHR/P			6846
S4	Attenuator switch			A29
S5	Supply switch			6718
T1	Modulation transformer			MT310
T2	Supply transformer Input 110-210-230-250V. 40-100 c/s on B4A, B4AC, B4B, B4BC			MT309
V1	ECC91 (6J6)			7034
V2	6SN7 GT			5873
V3	6X5GT			3150
X1	Silicon Crystal Rectifier. B.T.H. Type CS2A			7110
X3-6	Crystal Diode GE. Westinghouse WG5B			11538
	Instruction Manual			8347

The voltages shown on the circuit diagram were measured on an "Avometer" model 8 (20,000 ohms per volt d.c.).
The 3 Mc/s, r.f. measurement was taken on the Advance "Advac" a.c. millivoltmeter.
All the measurements were taken with generator set to 3 Mc/s, with modulation switched on and set to a depth of 50%.

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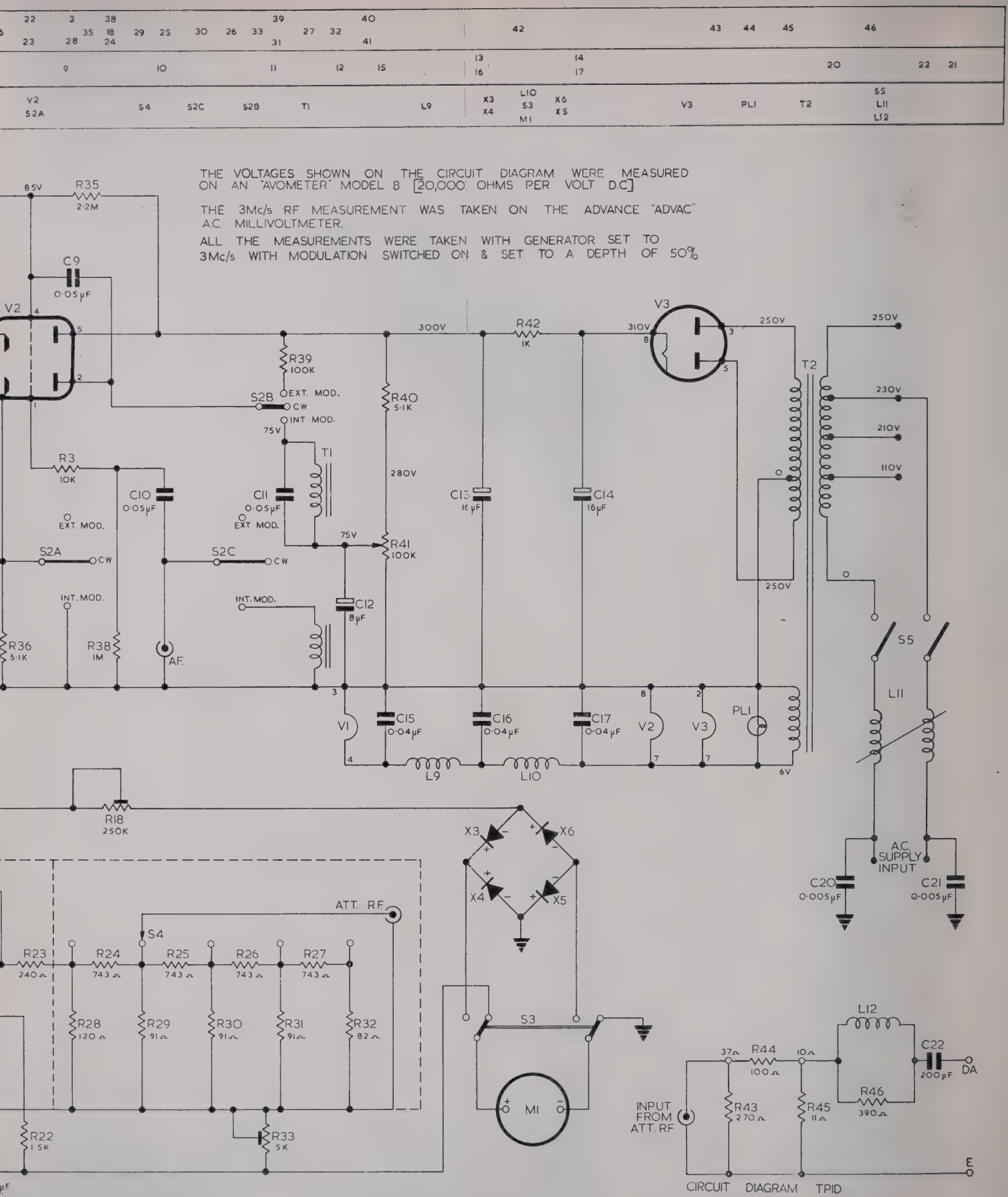

Circuit diagram B4

6 Amendments for 50Ω Models B4AC and B4BC

Reference to 75 ohms impedance should read 50 ohms.

Reference to 37 ohms impedance should read 25 ohms.

Termination Pad TP1D is replaced by TP1C.

RF lead PL5B is replaced by PL43.

AF lead PL18B is replaced by PL18A.

Circuit Diagram

R23 is 162 ohms Part No. 362
R24 is 490 ohms Part No. 365
R25 is 490 ohms Part No. 365
R26 is 490 ohms Part No. 365
R27 is 490 ohms Part No. 365
R28 is 82.5 ohms Part No. 6251
R29 is 62 ohms Part No. 363
R30 is 62 ohms Part No. 363
R31 is 62 ohms Part No. 363
R32 is 56 ohms Part No. 364
R43 is 91 ohms Part No. 372

7 Factory Service

Our factory Service Department is at your disposal should you wish to obtain further repair information by telephone or letter. The Type and Serial Number of the instrument should always be quoted. We maintain an efficient Service facility and the instrument can, if necessary, be returned to our factory for repair.

The instrument is guaranteed for a period of one year from its delivery to the purchaser for the replacement of defective parts, other than valves, semiconductors and fuses.

Valves and semiconductors are subject to the manufacturer's guarantee.

Equipment returned to us for servicing must be adequately packed, preferably in the special box supplied, and shipped with transportation charges prepaid. We can accept no responsibility for instruments arriving damaged. Should the cause of failure during the guarantee period be due to misuse or abuse of the instrument, or if the guarantee has expired, the repair will be charged and put in hand without delay unless other instructions are received.

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